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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
1763	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/608,091	STEGER, ROBERT J.	
	Examiner Rakesh K. Dhingra	Art Unit 1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 29 May 2007.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-31 is/are pending in the application.
 - 4a) Of the above claim(s) 13, 14 and 24 -31 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-12 and 15-23 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 07 September 2006 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>04/07</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION***Response to Arguments***

Applicant's arguments, see pages 7-29, filed 5/29/07 (appeal brief), with respect to the rejection(s) of claim(s) 1-12, 15-23 under 35 USC 103 (a) have been fully considered and following comments are furnished:

Claims 1-31 are currently pending out of which claims 1-12 and 15-23 are presently active.

Claims 1, 2, 4, 6, 7, 12 – Applicant's arguments regarding Tamura et al not explicitly disclosing an electrostatic chuck and, and Matsumura not disclosing the thickness of heat transfer member as result effective variable have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made under 35 USC 103 (a) in view of Yatsuda et al (US Patent No. 6,488,863), Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) regarding claims 1, 2, 4, 7, 10 and 12.

Dependent claim 3 – applicant's argument that in Kadotani the heating / cooling rate would be very slow compared to applicant's disclosure, is not found persuasive since Kadotani teaches for a plasma processing apparatus that dimensions of coolant passages are related to heat transfer from the coolant to the electrode block 201(heat transfer member). Thus coolant flow passage dimensions would be result effective variable that could be optimized for a required heat transfer rate, as per process limitations like flow rate, type of coolant etc. Further, though Kadotani et al apparatus uses a heat transfer gas, his teachings could be used for optimizing flow passage dimensions where a liquid is used in place of gas coolant, since use of both gas and liquid coolants in plasma processing apparatus is known in the art. Thus claim 3 has been rejected in view of Yatsuda et al, Tamura et al, Ramanan et al and Kadotani et al as explained below.

Dependent claim 5 – Applicant's arguments regarding Oda using a gas rather than a liquid in the peltier device is found persuasive. Therefore, the rejection has been withdrawn. However, upon further

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consideration, a new ground(s) of rejection is made under 35 USC 103 (a) in view of Yatsuda et al, Tamura et al, Ramanan et al and Kadotani et al (US PGPUB No. 2001/0018828) as explained below.

Dependent claim 8: applicant's argument about Yatsuda not disclosing a gap between heat transfer member and flange of ceramic member for thermal expansion, is not found persuasive since though Yatsuda does not disclose such a gap, Mahawili teaches such a gap to account for thermal expansion of platform 10 and heater housing 22 (made from dissimilar materials), as explained below. Examiner notes that applicant has not disclosed any criticality for such a gap/spacing.

Thus claim 8 has been rejected in view of Yatsuda et al, Tamura et al, Ramanan et al and Mahawili as explained below.

Claims 15, 18, 23 - applicant's argument that Kadotani does not provide any disclosure of the claimed heat transfer rate of 0.25-2 degrees C/sec is not found persuasive since Kadotani et al teaches that by controlling the flow rate and temperature of coolant, the temperature distribution of the electrode block 201 (heat transfer block) can be controlled. Kadotani et al also teach that heat transfer rate in the electrode block can be controlled by controlling the coolant flow rate. It would therefore be obvious to optimize the coolant flow rate and temperature of the coolant (as result effective variables) to obtain required heat transfer rate in the electrode block (for heating and / or cooling the heat transfer member) [for example, paragraphs 0066, 0077]. Further, though Kadotani et al does not explicitly teach that coolant flow channels carry liquid coolant, it would be obvious to use his teachings to obtain desired heat transfer rate for liquid coolant, since use of both gas and liquid coolants during semiconductor wafer processing is known in the art. Thus claims 15, 16, 18, 21 and 23 have been rejected in view of Yatsuda et al, Tamura et al, Ramanan et al and Kadotani et al as explained below.

Dependent claim 19: Applicant's argument regarding heat transfer member being spaced from the flange of ceramic member have already been responded above under claim 8 and accordingly claim 19 has been rejected as explained below.

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Remaining claims 9, 17, 19, 20 and 22 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4, 7, 10, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686).

Regarding Claims 1, 2: Yatsuda et al teach a substrate support for plasma processing comprising:
An insulating ceramic member 20;
A metallic worktable 18 (heat transfer member – made from aluminum) overlying the ceramic member 18 and including cooling passageway 34 (flow passage) through which a coolant can be circulated to control temperature of the worktable 18;
An electrostatic chuck 28 overlying the worktable 18 and having a support surface for supporting a substrate W in a reaction chamber 16 of a plasma processing apparatus (column 3, lines 15-65).

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Yatsuda et al do not explicitly teach that coolant is a liquid coolant and also do not teach the heat transfer member having a maximum thickness about $\frac{1}{4}$ inch.

However use of liquid as a coolant for temperature controlled substrate holders for plasma processing apparatus is known in the art as per reference cited hereunder.

Tamura et al teach a wafer holding device (Figure 9) comprising a heat transfer member 2 with liquid coolant flow passages 42 and where the heat transfer member can be made in two parts (Figure 15) {that is, metallic member 52 with coolant passages 42 and a holding member 53} which can then be joined together. Tamura et al further teach use of liquid coolant for flowing through coolant passages 42 (Figures 9, 15) and a heat transfer gas source operable to supply a heat transfer gas between the support surface and the substrate (Fig. 9 Item 21 (paragraphs 0081-0083).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a liquid coolant for temperature control of heat transfer member as taught by Tamura et al in the apparatus of Yatsuda et al as a known fluid for cooling during plasma processing of semiconductor wafers.

Yatsuda et al in view of Tamura et al do not teach heat transfer member having a maximum thickness of about $\frac{1}{4}$ inch.

However, thickness of heat transfer member is related to its thermal mass and it would be obvious to select thickness of the heat transfer member to obtain a desired thermal response during processing of a substrate, as per reference cited hereunder.

Ramanan et al teach a wafer processing apparatus (Figures 1a-1c) comprising:

A low thermal mass conductive heating member 20 for heating a wafer 12 in a chamber 16. Ramanan et al further teach that the thickness and diameter of heating member are related to thermal mass of the heating member. Ramanan et al further teach that for efficient and rapid heating/cooling of a workpiece, the heating member should have low thermal mass and high thermal conductivity. Ramanan et

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al also teach that as an example, for a low thermal mass ceramic heating member with a diameter ranging from 8-13 inch, the thickness can be less than $\frac{1}{2}$ inch and preferably from about 0.06 to 0.25 inch and having thermal mass varying from 500-2000 joules/C (column 8, line 15 to column 9, line 13). Thus thickness of heating member is a result effective variable that can be optimized to obtain a desired thermal mass, required as per process limitations. Though Ramanan et al do not explicitly teach metallic heating member (heat transfer member), his teaching could be applied to determine its optimum thickness as per process limitations like wafer size etc.

Therefore it would be obvious to optimize thickness of the heat transfer member as taught by Ramanan et al in the apparatus of Yatsuda et al to provide rapid thermal response and agility during wafer processing, as per process limitations.

In this connection courts have ruled:

"It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980)."

Regarding Claim 4: Tamura et al disclose that substrate support further comprises a coolant supply portion 43 (source of temperature controlled liquid) in flow communication with the at least one flow passage 42 (Fig. 9 Item 43 and column 14, lines 35-50).

Regarding Claim 7: Tamura et al discloses the heat transfer member can comprises a holding member 53 with a flow passage (base) and a metallic member 52 (cover) overlying the base (Figures 15, 16 and column 19, lines 1-20).

Regarding Claim 10: Yatsuda et al teach an RF power source 48 electrically connected to the worktable 18 (heat transfer member) through a lead line 44 {Figure 1}.

Regarding Claim 12: Yatsuda et al discloses a plasma processing apparatus comprising the substrate support of Claim 1 (Fig. 1).

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Claims 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) as applied to claim 1 and further in view of Kadotani et al (US PGPUB No. 2004/0163601).

Regarding Claim 3: Yatsuda et al in view of Tamura et al and Ramanan et al teach all limitations of the claim except coolant flow passage dimensions.

Kadotani et al teach an apparatus (Figures 1, 7) that includes a substrate support for supporting a wafer W and having an electrode block 1 (heat transfer member) with coolant flow passages 11, 12. Kadotani et al further teaches that dimensions of coolant passages are related to heat transfer from the coolant to the electrode block (heat transfer member). Thus coolant flow passage dimensions would be result effective variable that could be optimized for the required heat transfer rate as per process limitations like flow rate, type of coolant etc. Further, though Kadotani et al apparatus uses a heat transfer gas, his teachings could be used for optimizing flow passage dimensions where a liquid is used in place of gas coolant, since use of both gas and liquid coolants in plasma processing apparatus is known in the art [for example, paragraphs 0077].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to control (optimize) coolant flow passage dimensions (result effective variable), as taught by Kadotani et al in the apparatus of Yatsuda et al in view of Tamura et al and Ramanan et al for achieving required heat transfer rate between coolant and the heat transfer member, as per process limitations like type of coolant, coolant flow rate etc.

In this connection courts have ruled:

“It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).”

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 4 and further in view of Kadotani et al (US PGPUB No. 2001/0018828).

Regarding Claim 5: Yatsuda et al in view of Tamura et al and Ramanan et al teach all limitations of the claim except the source of temperature controlled liquid includes a Peltier cooler operable to change the temperature of the liquid to a selected temperature.

Kadotani et al teach an apparatus for fluid temperature control (Figure 1) for comprising:

A fluid passage 25 for flowing the fluid whose temperature is to be controlled (fluid can be water or ethylene glycol etc);

Cooling pipes 9 for flow of cooling liquid (water or refrigerant); and

Thermo-electric elements 7 (peltier elements) that absorb the heat from the fluid and discharge the same to cooling liquid (abstract and paragraphs 0040-0043, 0052).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use peltier (thermoelectric) devices as taught by Kadotani et al in the apparatus of Yatsuda et al in view of Tamura et al and Ramanan et al for accurately controlling temperature of cooling liquid over a wide temperature range.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178), Ramanan et al (US patent No. 6,529,686) and Kadotani et al (US PGPUB No. 2004/0163601) as applied to claim 4 and further in view of Yang et al (US 6,635,580).

Regarding Claim 6: Yatsuda et al in view of Tamura et al and Ramanan et al teach all limitations of the claim including a heat transfer gas source operable to supply a heat transfer gas between

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the support surface and the substrate (Fig. 9 Item 21), and a controller operable to (i) control the volumetric flow rate and/or the temperature of the liquid circulated through the at least one flow passage (Tamura et al - Fig. 9 Item 43).

Yatsuda et al in view of in view of Tamura et al and Ramanan et al do not teach a controller operable to control operation of the heat transfer gas source for flow rate and pressure.

Yang et al discloses a controller operable to control operation of the heat transfer gas source for controlling pressure and flow rate of the heat transfer gas (Fig. 3 Item 80) [column 6, lines 25-50].

It would therefore have been obvious to a person of ordinary skill in the art at the time of the invention to use a controller operable to control operation of the heat transfer gas source for pressure and flow rate as taught by Yang et al in the apparatus of Yatsuda et al in view of in view of Tamura et al and Ramanan et al to control operation of the heat transfer gas, thereby enable control the temperature of the substrate.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) as applied to claim 1 and further in view of Mahawili (US patent No. 6,007,635).

Regarding Claim 8: Yatsuda et al in view of in view of Tamura et al and Ramanan et al teach all limitations of the claim including ceramic member 20 includes a recessed surface and a flange, and the heat transfer member 18 is disposed on the recessed surface, and further the electrostatic chuck 28 contacts the flange of the ceramic member 20 (Yatsuda et al – Figure 1).

Yatsuda et al in view of in view of Tamura et al and Ramanan et al do not teach heat transfer member is laterally spaced from the flange and the thickness of ceramic member at the recessed surface is about 1-4 mm.

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Though Yatsuda et al do not teach that worktable (heat transfer member) 18 is laterally spaced from the flange, but it would be obvious to do the same to allow for thermal expansion between the heat transfer member 18 (made from aluminum) and the ceramic member 20 at the high processing temperatures during wafer processing (examiner notes that applicant has not disclosed any criticality for such a gap). A supporting reference (by Mahawili) is also cited hereunder.

Mahawili teaches a substrate support apparatus (Figure 1) that includes a heater housing 22 with a support surface 21 in which a platform 10 (heat transfer member) is seated. Mahawili further teaches that heater housing 22 and platform 10 could be made from dissimilar materials like ceramic and aluminum respectively. Mahawili also teaches that support surface 21 of heater housing 22 is sized to permit unrestrained thermal expansion of platform 10 (that is, platform 10 is spaced from ceramic heater housing). Mahawili additionally teaches that recess depth of support surface 21 is sized so that substrate 12 is seated flush with the upper surface 22b of heater housing 22 second member 18 {column 4, line 1 to column 5, line 20}. Thus, depth of recess can be optimized (like a result effective variable) as per process limitations, like wafer thickness.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have a spacing between heat transfer member and ceramic member, and optimize ceramic member thickness at the recessed surface as taught by Mahawili in the apparatus of Yatsuda et al in view of in view of Tamura et al and Ramanan et al to allow for thermal expansion between heat transfer member (metallic) and the ceramic member, as per process limitations.

In this connection courts have ruled:

"It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980)."

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Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) as applied to claim 1 and further in view of Mimura et al (US Patent No. 7,022,616).

Regarding Claim 9: Yatsuda et al in view of in view of Tamura et al and Ramanan et al teach all limitations of the claim including a ceramic ring 36 (susceptor) overlying the ceramic member 40 and surrounding the heat transfer member 2 and the dielectric material 18, the heat transfer member being laterally spaced from the ceramic ring {Tamura et al – Figure 9}

Yatsuda et al in view of in view of Tamura et al and Ramanan et al do not teach the ceramic ring surrounding the electrostatic chuck and the electrostatic chuck contacting the ceramic ring.

Mimura et al teach a plasma apparatus (Figure 1) comprising a ceramic ring 5 overlying an insulating member 3 (normally made from ceramic) and surrounding a support table 2 (heat transfer member), and an electrostatic chuck 6 that is in contact with and surrounded by the ceramic ring 5 (column 3, lines 5-65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention use a ceramic ring that contacts and surrounds an electrostatic chuck as taught by Mimura et al in the apparatus of Yatsuda et al in view of in view of Tamura et al and Ramanan et al to enable shield the electrostatic chuck from deposition by the reaction products.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) as applied to claim 1 and further in view of Wang et al (US PGPUB No. 2002/0075624).

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Regarding Claim 11: Yatsuda et al in view of in view of Tamura et al and Ramanan et al teach all limitations of the claim except the substrate support further comprising an elastomeric joint between the ceramic member and the heat transfer member, and an elastomeric joint between the heat transfer member and the electrostatic chuck.

Wang et al teach a plasma apparatus (Figures 1, 2, 6) comprising an electrostatic chuck assembly 55 that includes an electrostatic member 100 (electrostatic chuck) is bonded to base 175 (heat transfer member) by a ductile and compliant layer 250 (elastomeric joint). Wang et al also teach that base 175 is in turn bonded to support 190 (ceramic member) by a compliant and ductile material 295 (elastomeric joint) [paragraphs 0036, 0038, 0056, 0063, 0066].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention use elastomeric joints for bonding ceramic member, electrostatic chuck and heat transfer member as taught by Wang et al in the apparatus of Yatsuda et al in view of in view of Tamura et al and Ramanan et al to absorb thermal stresses arising due to different thermal coefficients of expansion of the interfacing materials (paragraph 0056).

Claims 15, 16, 18, 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178) and Ramanan et al (US patent No. 6,529,686) in view of Kadotani et al (US PGPUB No. 2004/0163601).

Regarding Claims 15, 16: Yatsuda et al in view of in view of Tamura et al and Ramanan et al teach all limitations of the claim (as already explained above under claim 1) including heat transfer member with liquid flow passages.

Yatsuda et al in view of in view of Tamura et al and Ramanan et al do not teach that liquid circulation through heat transfer member enables to heat and/or cool the heat transfer member at a rate of 0.25 – 2 degrees C/sec.

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Kadotani et al teach an apparatus (Figures 1-7) that includes a substrate support for supporting a wafer W and having an electrode block 1 (like heat transfer member) with coolant flow passages 11, 12. Kadotani et al further teaches that by controlling the flow rate and temperature of coolant, the temperature distribution of the electrode block 201 (heat transfer block) can be controlled. Kadotani et al also teach that heat transfer rate in the electrode block can be controlled by controlling the coolant flow rate. It would therefore be obvious to optimize the coolant flow rate and temperature of the coolant (as result effective variables) to obtain required heat transfer rate in the electrode block (for heating and / or cooling the heat transfer member) [for example, paragraphs 0066, 0077]. Further, though Kadotani et al does not explicitly teach that coolant flow channels carry liquid coolant, it would be obvious to use his teachings to obtain desired heat transfer rate for liquid coolant, since use of both gas and liquid coolants during semiconductor wafer processing is known in the art.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain desired heat transfer rate between coolant and the heat transfer member (0.25 –2 degrees C/sec) as taught by Kadotani et al in the apparatus of Yatsuda et al in view of Tamura et al and Ramanan et al by optimizing result effective variables like coolant flow rate and coolant temperature, as per process limitations.

In this connection courts have ruled:

“It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).”

Regarding Claim 18: Tamura et al discloses the heat transfer member can comprise a holding member 53 with a flow passage (base) and a metallic member 52 (cover) overlying the base (Figures 15, 16 and column 19, lines 1-20).

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Regarding Claim 21: Yatsuda et al teach an RF power source 48 electrically connected to the worktable 18 (heat transfer member) through a lead line 44 {Figure 1}.

Regarding Claim 23: Yatsuda et al discloses a plasma processing apparatus comprising the substrate support of Claim 1 (Fig. 1).

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178), Ramanan et al (US patent No. 6,529,686) and Kadotani et al (US PGPUB No. 2004/0163601) as applied to claim 15 and further in view of Yang et al (US 6,635,580).

Regarding Claim 17: Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al teach all limitations of the claim including a controller operable to control operation of the coolant fluid [Column 15 Lines 41-47 – Tamura et al]. Tamura et al also teach a heat transfer gas source operable to supply a heat transfer gas between the support surface and the substrate.

Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al do not teach a controller operable to control operation of the heat transfer gas source.

Yang et al discloses a controller operable to control operation of the heat transfer gas source for controlling pressure and flow rate of heat transfer gas (Fig. 3 Item 80) [column 6, lines 25-50].

It would therefore have been obvious to a person of ordinary skill in the art at the time of the invention to use a controller operable to control operation of the heat transfer gas source as taught by Yang et al in the apparatus of Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al to control operation of the heat transfer gas, thereby enable control the temperature of the substrate.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178), Ramanan et al (US patent No. 6,529,686) and Kadotani et al (US PGPUB No. 2004/0163601) as applied to claim 15 and further in view of Mahawili (US patent No. 6,007,635).

Regarding Claim 19: Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al teach all limitations of the claim including ceramic member 20 includes a recessed surface and a flange, and the heat transfer member 18 is disposed on the recessed surface, and further the electrostatic chuck 28 contacts the flange of the ceramic member 20 (Yatsuda et al – Figure 1).

Yatsuda et al in view of Tamura et al and Ramanan et al do not teach heat transfer member is laterally spaced from the flange.

Though Yatsuda et al do not teach that worktable (heat transfer member) 18 is laterally spaced from the flange, but it would be obvious to do the same to allow for thermal expansion between the heat transfer member 18 (made from aluminum) and the ceramic member 20 at the high temperatures during wafer processing (examiner notes that applicant has not disclosed any criticality for such a gap). A supporting reference (by Mahawili) is also cited hereunder.

Mahawili teaches a substrate support apparatus (Figure 1) that includes a heater housing 22 with a support surface 21 in which a platform 10 (heat transfer member) is seated. Mahawili further teaches that heater housing 22 and platform could be made from dissimilar materials like ceramic and aluminum respectively. Mahawili also teaches that support surface 21 of heater housing 22 is sized to permit unrestrained thermal expansion of platform 10 (that is, platform 10 is spaced from ceramic heater housing){column 4, line 1 to column 5, line 20}.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have a spacing between heat transfer member and ceramic member as taught by Mahawili in

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the apparatus of Yatsuda et al in view of in view of Tamura et al, Ramanan et al and Kadotani to allow for thermal expansion between heat transfer member (metallic) and the ceramic member.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178), Ramanan et al (US patent No. 6,529,686) and Kadotani et al (US PGPUB No. 2004/0163601) as applied to claim 15 and further in view of Mimura et al (US Patent No. 7,022,616).

Regarding Claim 20: Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al teach all limitations of the claim including a ceramic ring 36 (susceptor) overlying the ceramic member 40 and surrounding the heat transfer member 2 and the dielectric material 18, the heat transfer member being laterally spaced from the ceramic ring {Tamura et al – Figure 9}.

Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al do not teach the ceramic ring surrounding the heat transfer member the electrostatic chuck and the electrostatic chuck contacting the ceramic ring.

Mimura et al teach a plasma apparatus (Figure 1) comprising a ceramic ring 5 overlying an insulating member 3 (normally made from ceramic) and surrounding a support table 2 (heat transfer member), and an electrostatic chuck 6 that is in contact with and surrounded by the ceramic ring 5 (column 3, lines 5-65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention use a ceramic ring that contacts and surrounds an electrostatic chuck as taught by Mimura et al in the apparatus of Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al to enable shield the electrostatic chuck from deposition by the reaction products.

Regarding Claim 21: Mimura et al teach RF power sources 15, 26 connected to table 2 (heat transfer member) [Figure 1 and column 3, lines 10-25].

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Tamura et al (US Patent No. 2001/0009178), Ramanan et al (US patent No. 6,529,686) and Kadotani et al (US PGPUB No. 2004/0163601) as applied to claim 15 and further in view of Wang et al (US PGPUB No. 2002/0075624).

Regarding Claim 22: Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al teach all limitations of the claim except the substrate support further comprising an elastomeric joint between the ceramic member and the heat transfer member, and an elastomeric joint between the heat transfer member and the electrostatic chuck.

Wang et al teach a plasma apparatus (Figures 1, 2, 6) comprising an electrostatic chuck assembly 55 that includes an electrostatic member 100 (electrostatic chuck) is bonded to base 175 (heat transfer member) by a ductile and compliant layer 250 (elastomeric joint). Wang et al also teach that base 175 is in turn bonded to support 190 (ceramic member) by a compliant and ductile material 295 (elastomeric joint) [paragraphs 0036, 0038, 0056, 0063, 0066].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention use elastomeric joints for bonding ceramic member, electrostatic chuck and heat transfer member as taught by Wang et al in the apparatus of Yatsuda et al in view of Tamura et al, Ramanan et al and Kadotani et al to absorb thermal stresses arising due to different thermal coefficients of expansion of the interfacing materials (paragraph 0056).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Rakesh K. Dhingra



Karla Moore
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Art Unit 1763